REMARKS

Summary Of The Office Action & Formalities

Claims 1-8 are all the claims pending in the application. By this Amendment, Applicants are adding new claims 9-12. No new matter is added.

The Examiner has withdrawn the finality of the previous Office Action date May 14, 2002, in response to Applicants' Appeal Brief and has entered Applicants' new claims 7 and 8.

Claims 7 and 8 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

The prior art rejections are now summarized as follows:

1. Claims 1-6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamazaki (USP 4,816,113) and Kitsunai et al. (USP 6,186,153).

Applicants respectfully traverse the prior art rejection.

Claim Rejections - 35 U.S.C. § 103

1. Claims 1-6 In View Of Yamazaki and Kitsunai et al.

In rejecting claims 1-6 in view of Yamazaki and Kitsunai et al., the grounds of rejection state that

> Yamazaki teaches a method for forming a carbon layer by vapor phase deposition comprising steps of: cleaning the apparatus by removing undesirable products such as carbon deposition from the inside of the chamber (in between the carbon deposition or this would means the cleaning is performed before another deposition); the chamber is then evacuated to $1x10^{6}$ Torr or a higher vacuum condition; starting a film deposition process of the carbon (co. 5, line 41-col. 6, line 2; col. 3, line 41-col. 4, line

> 2). Unlike claimed invention, Yamazaki doesn't describe adjusting the content of particles having a particle size of 0.5 um or more to 1000 particles/ft^3/min or less (such as 500 or 100 particles/ft^3/min). However, to have a clean chamber before any deposition process is a well-known step to one skilled in the art as shown by Yamazaki's cleaning step. Also as shown here by Kitsunai where he teaches of cleaning any possible dust or contamination from the chamber so that they do not cause defects on the devices being manufactured (col. 1, line 14-40; col. 2 line 40-47). Therefore, it would have been obvious at the time of the invention for one skilled in the art to removed any dust, particles, which would includes any particles having size 0.5 um or more, so that they do not cause defects on the devices being manufactured.
>
> Referring to claim 3, the application of deposition of carbon layer as a protective layer on a thermal head performing thermal recording is known to one skill in the art as described in the background of the specification.
>
> Referring to claims 5 and 6, forming a thermal head having a 3 protective layers including a lower, intermediate, and carbon layer are well known to one skill in the art as described in page 8 of the specification. The thickness of each layer would have been obvious to determined through test runs in order to provide optimum thickness of each layer for protection of the thermal head with an anticipation of an expected result.

Office Action at pages 2-3 (emphasis added).

First, Applicants arguments set forth in their Appeal Brief remain pertinent to the extent that the Examiner continues to rely on Yamazaki. Accordingly, Applicants maintain and incorporate their previous arguments as if fully set forth herein.

In particular, the Examiner acknowledges that Yamazaki does not disclose the claimed feature of "adjusting a content of particles having a particle size of 0.5 μm or more in a film deposition system of the carbon layer to 1000 particles/ft^3/min or less . . . ." Therefore, in order to reject claims 1-6 in view of Yamazaki, the Examiner relies on Kitsunai et al. for its alleged

disclosure of cleaning any possible dust or contamination from the chamber so that they do not cause defects on the devices being manufactured (col. 1, line 14-40; col. 2 line 40-47).

The subject matter of the claimed invention relates to a method of forming a carbon layer using a vapor phase deposition technique, such as sputtering or chemical vapor deposition. More particularly, the invention is characterized by the numerical limitation that a content of particles having a particle size of 0.5 μm or more in a vapor phase deposition system (chamber) is adjusted to 1000 particles /ft^3/min or less. The present invention has particular applicability when forming a carbon protective layer in a protective coating of a thermal recording head, but is also applicable to forming protective coatings on other articles, such as magnetic heads, molds for plastic, and tools.

Known techniques for protective coatings include the application of a carbon-based protective layer (carbon protective layer). However, a serious problem encountered with conventional methods for manufacturing such protective layers is the existence of pinholes and/or cracks in the protective layer; thermal shocks or stress due to heating of the heating elements, stress due to differences in the coefficient of expansion between the carbon protective layer and the neighboring layer, mechanical impact due to the presence of foreign matter lodged between the thermal material and the thermal head (glaze), and other factors that cause cracking or delamination.

Applicants' invention addresses these problems by providing a carbon-based layer forming method by using a vapor phase deposition technique such as sputtering or CVD, in

which the method ensures that a high quality carbon layer having significantly reduced pinholes or cracks is produced.

Kitsunai et al. discloses a method of manufacturing semiconductor devices by use of a semiconductor manufacturing apparatus having its inside cleaned. Therefore, the disclosure of Kitsunai et al. has no relation to the formation of a carbon protective layer against abrasive wear, and clearly does not recognize the unique wear problems of such layers as noted above.

The Examiner's citation to column 1, lines 4 to 40 of Kitsunai et al. merely discloses a technique that "deposition films adhere to the inner walls of the apparatus for manufacturing semiconductor devices, and when the film thickness is increased, such deposition films partly peel off and then act as dust or contaminants which cause pattern defects in the devices being manufactured. Accordingly, it is necessary for such adhesion deposits to be removed periodically." Column 2, lines 40 to 47, of Kitsunai et al. merely discloses the object of the alleged invention as "a dry cleaning method which is capable of effectively removing any deposition films left adhered on the inner walls of the manufacturing apparatus and is also capable of successfully removing any possible dust production sources."

In other words, Kitsunai et al. discloses that any deposition films left adhered on the inner walls of the apparatus for manufacturing semiconductor devices may be dust production sources and that an object of the invention is to remove the dust production sources, but no mention is made as to what degree particles of a certain size are to be removed. Kitsunai et al. makes no specific disclosure on the particle size or the content of particles.

Clearly, therefore, the disclosure in Kitsunai et al. upon which the Examiner relies to reject claim 1 is no more than a generalized disclosure that fails to teach any particular degree of cleanliness for carbon layer formation. That the reference refers to the removal of "any possible dust production source" cannot be reasonably relied upon as a teaching of all possible degrees of cleanliness in all applications. Accordingly, Applicants submit that one skilled in the art would not have recognized from such a generalized disclosure the particular range for adjusting the content of particles having a particle size of 0.5μm or more in the carbon film deposition system, especially when one considers the context of the cleaning process disclosed in Kitsunai et al.

Moreover, the Examiner has not set forth sufficient motivation for why one skilled in the art would have looked to the cleaning method disclosed in Kitsunai et al. to adjust the particle content as recited in claim 1 when applying the carbon layer in accordance with Yamazaki.

The Federal Circuit reminds us that the USPTO is held to a rigorous standard when trying to show that an invention would have been obvious in view of the combination of two or more references. See, In re Sang Su Lee, 2002 U.S. App. LEXIS 855, *10 (Fed. Cir. 2002), citing, e.g., In re Dembiczak, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references.").

The Federal Circuit goes on to emphasize that the "need for specificity pervades this authority." In re Sang Su Lee at *10-*11 (emphasis added) (citing In re Kotzab, 217 F.3d 1365, 1371, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) ("particular findings must be made as to the

reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed").

Applicants respectfully submit that the current grounds of rejection do not satisfy the Federal Circuit's rigorous standard for demonstrating that the claimed invention would have been obvious in view of the combination of Yamazaki and Kitsunai et al. Indeed, Kitsunai et al. discloses a dry cleaning method that is specifically used in a plasma etching apparatus and involves the use of a plasma of cleaning gases that have particular interatomic bonding properties relative to the etching gas and the material to be etched.

More specifically, the cleaning process disclosed in Kitsunai et al. basically includes, in addition to the dry cleaning which is performed using a first cleaning gas for removing etching reaction products, an additional dry cleaning step as follows:

> performing a second cleaning treatment using a plasma of a second cleaning gas, to remove chemical components which are reaction products of a reaction between (a) residual etched material attached to the inner walls of the apparatus and/or to the internal components thereof and (b) the first cleaning gas, said second cleaning gas containing therein a material that forms bonds with constituent elements of said chemical components, wherein said bonds have a greater bond energy than that of bonds within said reaction products of the reaction between said residual etched material and said first cleaning gas.

Kitsunai et al. at column 9, lines 12-17, claim 1. The cleaning process of Kitsunai et al. utilizes the plasma as in the dry etching process for removing undesired carbon products disclosed by Yamazaki. Therefore, similar to what was stated in Applicants' Appeal Brief with respect to Yamazaki, it would take too much time to remove foreign matter of about 10 to about 100 μm in

thickness adhered to the inner walls of the chamber by the dry cleaning process of Kitsunai et al. Thus, the dry cleaning process cannot realistically be adopted.

Moreover, while Kitsunai et al. does not disclose specific numerical values for the electromagnetic wave (microwave) that is used in the microwave etching apparatus disclosed in Fig. 1 of the reference, Applicants believe that the frequency is different from that used in the microwave CVD apparatus disclosed in Fig. 1 of Yamazaki. Nonetheless, with regard to the cleaning process as described above, the disclosures of Kitsunai et al. and Yamazaki belong to the similar technical fields that are unrelated to the field of the present invention.

Additionally, the present invention cannot be attained by the combination of Kitsunai et al. with Yamazaki, since, as noted above, Kitsunai et al. does not specifically disclose the particle size or the content of particles, nor does Kitsunai et al. disclose to which degree particles of a certain size are to be removed.

Moreover, regarding claim 6, in particular, the Examiner has not pointed to any prior art disclosure of the various thickness ranges recited in this claim. Rather, the Examiner has merely concluded, without more, that such ranges are a matter of routine experimentation. Appellants disagree. "A particular parameter must first be recognized as a result-effective variable . . . before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation." MPEP § 2144.05(b). The grounds of rejection are fatally flawed, since they do not address this threshold inquiry at all. Moreover, as explained in Appellants' specification at page 16, these ranges ensure good adhesion, shock absorption, and durability of the protective coating.

In view of the foregoing distinctions, independent claim 1 and dependent claims 2-6 are believed to be allowable. Therefore, the Examiner is kindly requested to reconsider and allow these claims.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Submitted herewith is a Petition For Extension Of Time with fee.

Applicants hereby petition for any extension of time which may be required to maintain the pendency of this case, and any required fee, except for the Issue Fee, for such extension is to be charged to Deposit Account No. 19-4880.

Respectfully submitted,

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APPENDIX

Claims 9-12 are added as new claims.